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FLOOD INSURANCE STUDY

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ORIGINAL

CITY OF WARREN, MICHIGAN

MACOMB COUNTY

ORIGINAL

REVISED:

MAY 15, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 260129

NOTICE TO
FLOOD INSURANCE STUDY USERS

Individual components of this Flood Insurance Study (i.e., text, tables, profiles, and maps) are all subject to revision as additional data become available. Because revised components may be issued separately, study users should consult the community map repository for those components that are currently effective.

In cases where this Flood Insurance Study and any components thereof warrant revision, a Revisions Description section may be incorporated into this text. When applicable, study users should refer to the Revisions Description to obtain pertinent data and information concerning revisions.

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

CITY OF WARREN,
MACOMB COUNTY, MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Warren, Macomb County, Michigan, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert the City of Warren to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain management.

1.2 Coordination

The identification of streams requiring detailed study was performed at the initial community meeting on February 11, 1976, which was attended by officials of the City of Warren and Macomb County, and representatives of the Federal Insurance Administration and Johnson & Anderson, Inc.

Information was obtained from the city engineers of Warren, Troy, and Madison Heights, as well as the Macomb County Drain Commission, Macomb County Planning Commission, and Macomb County Road Commission. The Detroit District of the U. S. Army Corps of Engineers (COE) provided data in the form of high water marks and recent flooding records. Additional information was provided by the Red Run Drain - Lower Clinton River Study Advisory Committee.

The hydrologic and hydraulic analyses for the streams studied in detail were coordinated with the Michigan Department of Natural Resources by the firm of Johnson & Anderson, Inc. The analyses were reviewed and approved by the Michigan Department of Natural Resources, the State Coordinating Agency.

On June 22, 1978, the results of the study were reviewed and accepted at a final coordination meeting attended by representatives of the City of Warren, the Federal Insurance Administration, and Johnson & Anderson, Inc.

1.3 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

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The hydrologic and hydraulic analyses for this study were performed by Johnson & Anderson, Inc. for the Federal Insurance Administration, under Contract No. H-3816. This work, which was completed in November 1977, covered all significant flooding sources affecting the City of Warren.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Warren. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, areas of projected development and proposed construction until 1982. The scope and methods of study were proposed to and agreed upon by the Federal Insurance Administration and the community.

Floods caused by the overflow of the Red Run Drain and its three major tributaries, Big Beaver Creek, Bear Creek, and Meckler Drain, were studied in detail. Specifically, Red Run Drain was studied from Fourteen Mile Road to Dequindre Road; Big Beaver Creek was studied from its mouth at Red Run Drain to Fourteen Mile Road; Bear Creek was studied from its mouth at Red Run Drain to Van Dyke Road; and Meckler Drain was studied from its mouth at Red Run Drain to the Conrail Service Road.

2.2 Community Description

The City of Warren is located in the southwest corner of Macomb County, which is in the southeastern portion of Michigan's lower peninsula. The communities of Hazel Park and Madison Heights bound the City of Warren on the west. To the north lies the City of Sterling Heights and to the south lies the City of Detroit. The City of Warren is bounded on the east by the Cities of Fraser, Roseville, and East Detroit. The 1973 population of Warren was about 192,000, increasing from about 179,000 in 1970 (Reference 1). Due to its location within the Detroit Metropolitan Area, a rapidly increasing growth rate has been predicted for Warren.

The development of the area adjacent to the Red Run Drain consists primarily of medium-density housing in the form of large subdivisions and apartment complexes. Commercial development is typically restricted to strip areas along major highways and regional shopping centers. An industrial corridor, consisting primarily of automotive parts manufacturers, extends along the Conrail railroad between Mound and Van Dyke Roads.

The climate of Warren is affected by the proximity of the Great Lakes, which act to modify temperature extremes throughout the year. The maximum monthly average of 72 degrees Fahrenheit (F.) occurs in July and

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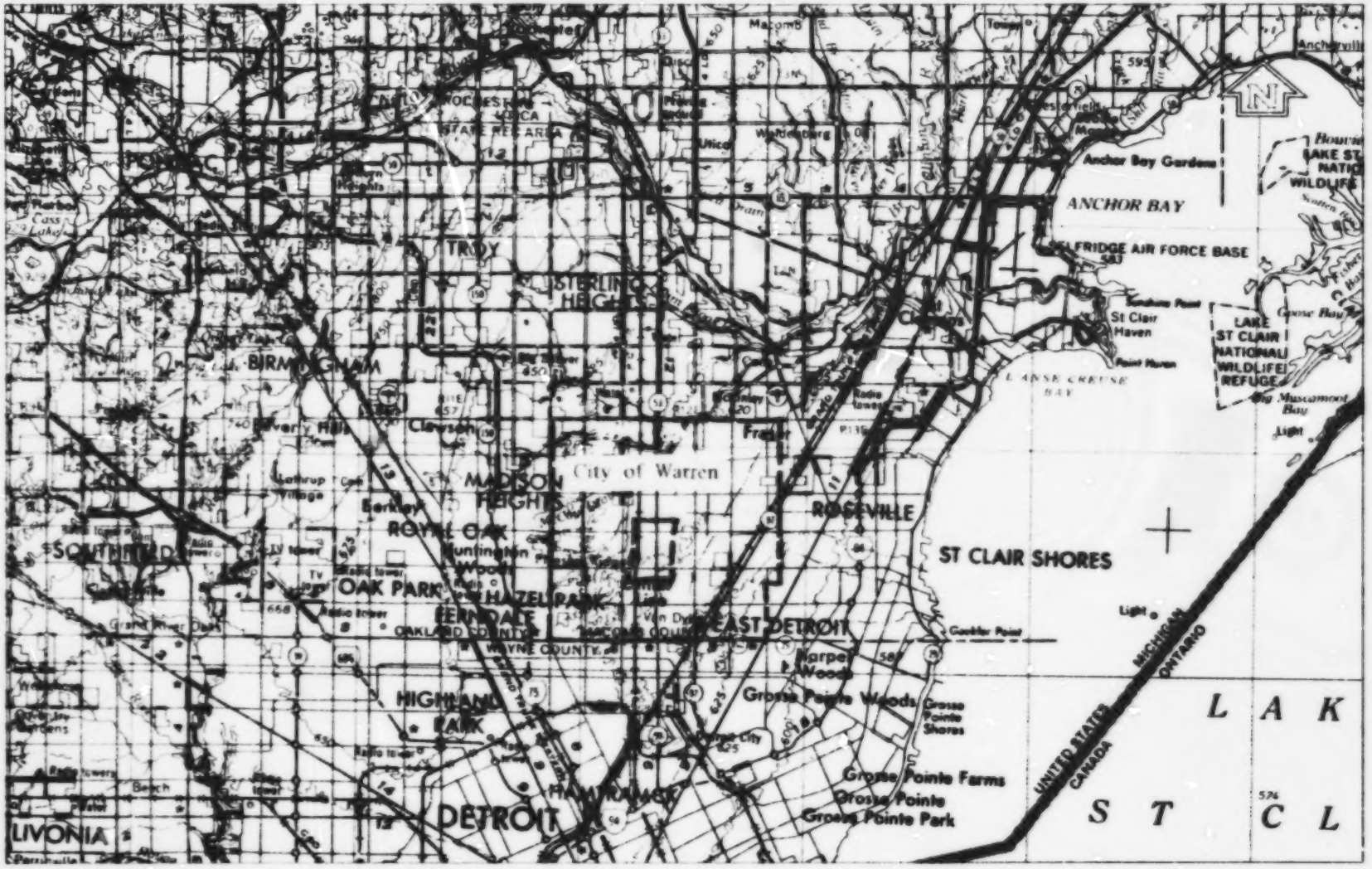

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI

(MACOMB CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

the minimum monthly average of 24 degrees F. occurs in January. The average annual precipitation of 28 inches includes about 30 inches of snow.

The City of Warren is located in an area of fairly level topography, and consists primarily of post-glacial lake beds and glacial moraines. Soils of the area are generally sandy clays, underlain by clays, with an occasional stratum of silty sand.

The Red Run Drain extends approximately 12.7 miles from its headwaters in highly urbanized Oakland County to its confluence with the Clinton River in eastern Macomb County, serving a drainage area of about 140 square miles. The Red Run Drain flows in a northeasterly direction across the northern portion of the City of Warren. The Big Beaver Creek flows in a southeasterly direction to its confluence with the Red Run Drain. The Bear Creek and Meckler Drain flow in a northeasterly direction to their confluences with the Red Run Drain.

Flood plain development consists primarily of scattered housing and subdivision areas in the vicinities of the Red Run Drain, Big Beaver Creek and Bear Creek, and industrial sections along the Red Run Drain and Meckler Drain between 12 Mile Road and 13 Mile Road.

2.3 Principal Flood Problems

Some local flooding has occurred in areas surrounding the Red Run Drain due to inadequate storm drainage. This type of flooding is usually experienced during the late winter and early spring, primarily due to snowmelt or rainfall on frozen or saturated ground. Other floods have been a result of localized intense rainfalls during the summer.

2.4 Flood Protection Measures

The principal flood protection measures for the City of Warren have been channel improvements to the Red Run Drain and the construction of the Henry Graham Drain in Troy which has significantly reduced the drainage area of the Big Beaver Creek. At the present time, the COE is studying various alternate methods for reducing flood stages along the Red Run Drain.

3.0 ENGINEERING METHODS

For flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Floods having recurrence intervals of 10-, 50-, 100-, and 500-years have been selected as having special significance for flood plain management and for flood insurance premium rates. The analyses reported here reflect current conditions in the watersheds of the streams.

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3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the community.

The frequency discharge data for the detailed study streams were computed using the Unit Hydrograph Infiltrating Capacity Method developed by Dr. Ernest F. Brater (Reference 2). This method utilizes relationships of streamflow, drainage area, and population density. Urbanization and channel conditions were considered for 1976 conditions. As urbanization affects imperviousness and channel conditions, flows can be expected to increase. Two other methods, a log-Pearson Type III gage analysis (Reference 3) and Soil Conservation Service (SCS) flood routing techniques (Reference 4) were used in conjunction with the Brater method.

The storage effects of the Red Run Drain flood plain cause a decrease in the discharge of Red Run Drain between its confluence with Bear Creek and Dequindre Road.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each stream studied in detail in the community are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community are carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each stream studied in detail.

All cross sections were obtained by field survey. Valley cross sections were located in places representing a typical stream reach. A total of 21 valley sections and eight bridge sections for the backwater analysis of the Red Run Drain, six valley sections and one bridge section for the Big Beaver Creek, four valley sections and two bridge sections for the Bear Creek, and three valley sections and three bridge sections for the Meckler Drain were utilized.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness coefficients (Manning's "n") for the computations on the streams in the City of Warren were determined by field inspection based on conditions in the watershed of the stream typical of summer. The channel roughness coefficients ranged from 0.025 to 0.04 while the overbank roughness factors ranged from 0.02 to 0.07.

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TABLE 1: SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA SQ MILES	PEAK DISCHARGES (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
RED RUN DRAIN					
Big Beaver Creek	90.6	9,700	14,900	17,100	24,000
At Bear Creek	86.0	9,680	14,700	16,900	23,600
Just Upstream of Bear Creek	63.6	6,680	10,100	11,700	16,400
At Dequindre Road	60.0	6,860	10,300	11,900	16,600
BIG BEAVER CREEK					
Mouth	4.6	820	1,230	1,420	1,990
BEAR CREEK					
Mouth	22.5	3,960	5,610	6,450	9,020
Just Upstream of Miller Drain	18.0	3,310	4,670	5,370	7,510
MECKLER DRAIN					
Mouth	1.3	460	730	840	1,160

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Water-surface elevations for the 10-, 50-, 100-, and 500-year floods for the Red Run Drain, Big Beaver Creek, Bear Creek, and Meckler Drain were computed using the COE HEC-2 step-backwater computer program (Reference 5).

The starting water-surface elevations for the Red Run Drain were obtained from the City of Sterling Heights Flood Insurance Study being conducted concurrently with the City of Warren Flood Insurance Study by Johnson & Anderson, Inc. (Reference 6). The Big Beaver Creek, Bear Creek, and Meckler Drain starting water-surface elevations were obtained from the corresponding Red Run Drain flood elevations at their respective confluences with the Red Run Drain.

Flood profiles for the Red Run Drain, Big Beaver Creek, Bear Creek and Meckler Drain were drawn showing computed water-surface elevations for floods of the selected recurrence intervals (Exhibit 1).

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles (Exhibit 1) are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using photogrammetric methods (Reference 7).

The boundaries of the 100-year and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations, and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to

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limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazard in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Insurance Administration limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The Michigan Flood Plain Act (Act 167, P.A. 1968), however, limits flood plain encroachment to that which will cause only insignificant increases in flood heights (less than 0.10 foot) (Reference 8).

In general, the technique used to define the recommended floodway in this report involved describing the sweep and extent of moving floodwater by applying engineering judgment and basic rules of hydraulics to the flooded outline maps. With this technique, the areas in the floodway fringe are areas of ponded water. Only areas with no conveyance (water-carrying ability) are included in the floodway fringe. The results of the floodway computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.10 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
RED RUN DRAIN								
A	17,368	426	3742	3.8	608.3	608.3	608.3	0.0
B	19,119	302	3340	4.3	608.6	608.6	608.7	0.1
C	20,219	588	4722	3.0	609.0	609.0	609.1	0.1
D	21,119	475	3603	4.0	609.1	609.1	609.2	0.1
E	22,069	200	2513	5.7	609.1	609.1	609.2	0.1
F	23,319	548	2964	4.4	609.5	609.5	609.6	0.1
G	23,569	543	2782	3.1	609.8	609.8	609.9	0.1
H	24,369	252	2170	4.0	609.8	609.8	609.9	0.1
I	25,819	475	1698	5.1	610.0	610.0	610.1	0.1
J	26,025	393	1800	4.8	610.7	610.7	610.8	0.1
K	26,900	175	1843	4.7	611.1	611.1	611.2	0.1
L	27,150	244	2141	4.1	611.1	611.1	611.2	0.1
M	27,900	149	1890	4.6	611.3	611.3	611.4	0.1
N	28,031	137	1841	4.7	612.0	612.0	612.0	0.0
O	28,331	322	2271	3.8	612.1	612.1	612.2	0.1
P	28,449	311	2121	4.1	612.7	612.7	612.7	0.0
Q	29,749	288	2716	3.2	613.1	613.1	613.2	0.1
R	31,199	131	1757	4.9	613.2	613.2	613.3	0.1
S	31,350	236	1966	4.4	614.5	614.5	614.5	0.0
T	31,483	220	2108	4.1	615.6	615.6	615.6	0.0
U	33,333	224	2491	3.5	615.9	615.9	615.9	0.0
V	33,438	243	2520	3.4	616.0	616.0	616.1	0.1
W	34,888	189	2165	4.0	616.2	616.2	616.3	0.1
X	37,038	145	2029	4.3	616.5	616.5	616.6	0.1
Y	37,121	207	1781	4.9	617.1	617.1	617.2	0.1
Z	39,121	143	1927	4.5	617.6	617.6	617.7	0.1
AA	41,121	106	1527	5.7	617.9	617.9	618.0	0.1
AB	42,521	161	2214	3.9	618.5	618.5	618.6	0.1

[1]FEET ABOVE MOUTH

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI

(MACOMB CO.)

FLOODWAY DATA

RED RUN DRAIN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
BIG BEAVER CREEK								
A	400	458	3057	0.5	609.5	608.4[2]	608.4	0.0
B	1200	376	2590	0.5	609.5	608.4[2]	608.4	0.0
C	2000	257	1393	1.0	609.5	608.4[2]	608.4	0.0
D	2800	98	557	2.5	609.5	608.5[2]	608.5	0.0
E	2996	60	571	2.5	609.5	608.8[2]	608.8	0.0
F	4100	273	853	1.7	609.5	609.2[2]	609.2	0.0
G	5200	93	587	2.4	609.5	609.5[2]	609.5	0.0
BEAR CREEK								
A	170	390	2362	2.7	610.0	610.0	610.0	0.0
B	1740	562	3017	2.1	610.4	610.4	610.4	0.0
C	2037	570	3068	1.8	610.6	610.6	610.6	0.0
D	2762	355	1758	3.1	610.7	610.7	610.7	0.0
E	3193	355	1885	2.8	611.1	611.1	611.1	0.0
F	3783	52	895	6.0	611.3	611.3	611.3	0.0
MECKLER DRAIN								
A	501	184	414	2.0	611.4	610.7[2]	610.7	0.0
B	897	116	280	3.0	611.4	610.9[2]	610.9	0.0
C	1065	253	575	1.5	612.7	612.7	612.7	0.0
D	1710	39	155	5.4	613.7	613.7	613.7	0.0
E	2000	240	316	2.7	614.5	614.5	614.5	0.0

[1]FEET ABOVE MOUTH
[2]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM RED RUN DRAIN

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI

(MACOMB CO.)

FLOODWAY DATA

BIG BEAVER CREEK—BEAR CREEK—MECKLER DRAIN

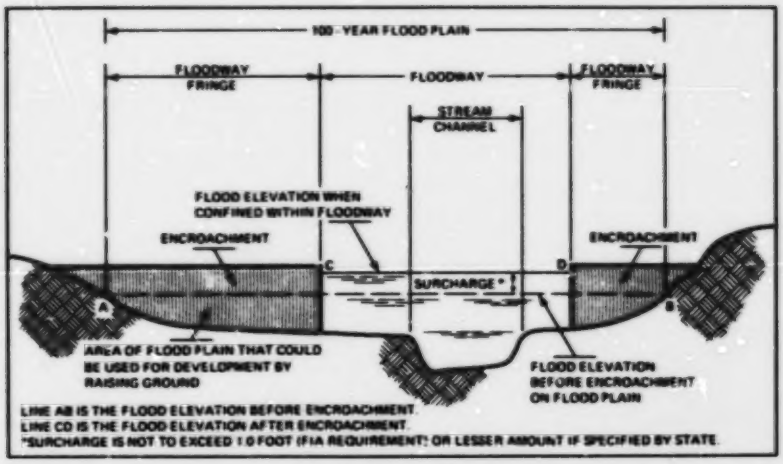
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2. Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source affecting the City of Warren.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

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Three reaches meeting the above criteria were required for the flooding sources of the City of Warren. These included two reaches on Red Run Drain and one reach on Meckler Drain. The location of the reaches is shown on the Flood Profiles (Exhibit 2).

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Insurance Administration device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their Flood Hazard Factors are used to set actuarial insurance premium rate tables based on Flood Hazard Factors from 005 to 200.

The Flood Hazard Factor for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the Flood Hazard Factor is 005; if the difference is 1.4 feet, the Flood Hazard Factor is 015; if the difference is 5.0 feet, the Flood Hazard Factor is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the Flood Hazard Factor is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire incorporated area of the City of Warren was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zones A2, A9, A13:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factor.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

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Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Warren is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Insurance Administration.

6.0 OTHER STUDIES

No other studies relating to flooding have been performed in the vicinity of the City of Warren. This study is compatible with the adjoining studies for the City of Sterling Heights and the City of Fraser (References 6 and 9)

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the office of the Federal Insurance Administration, Regional Director, One Dearborn Street, Chicago, Illinois 60602.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
RED RUN DRAIN							
REACH 1	0005,0010	−4.3	−0.5	1.6	045	A9	VARIES—SEE MAP
REACH 2	0005	−5.2	−0.1	0.3	050	A10	VARIES—SEE MAP
BEAR CREEK							
REACH 1	0010	−4.6	−1.0	2.4	045	A9	VARIES—SEE MAP
REACH 2	0005,0010	−3.0	−9.0	2.4	030	A6	VARIES—SEE MAP
MECKLER DRAIN							
REACH 1	0005	−0.8	−0.2	1.7	010	A2	VARIES—SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

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TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI
(MACOMB CO.)

FLOOD INSURANCE ZONE DATA

RED RUN DRAIN—BEAR CREEK—MECKLER DRAIN

8.0 REFERENCES AND BIBLIOGRAPHY

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5. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profile User's Manual, 1973.

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9.0 REVISIONS DESCRIPTION (Revised: May 15, 1986)

9.1 Purpose

The purpose of this Flood Insurance Study Revisions Description is to incorporate revised data into this currently effective Flood Insurance Study for the City of Warren, Macomb County, Michigan. This Revisions Description is intended to provide updated information that aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

9.2 Acknowledgments

The hydrologic and hydraulic analyses for this Revisions Description were performed by the Michigan Department of Natural Resources (DNR). The Federal Emergency Management Agency (FEMA) reviewed and accepted these data for purposes of this revision.

9.3 Scope

The entire reach of Red Run Drain within the City of Warren has been restudied. The Red Run Drain backwater previously shown on the profiles for Big Beaver Creek, Bear Creek, and Meckler Drain has been revised to reflect the new elevations on Red Run Drain.

9.4 Hydrologic and Hydraulic Analyses

Revised discharges for Red Run Drain were computed by the Michigan DNR.

The flood discharges were developed using the U.S. Army Corps of Engineers (COE) computer model HEC-SAM (Reference 1), which is a combination of several models allowing hydrologic, economic, and environmental analyses. The HEC-SAM model also contains a computerized data base consisting of resource variables within the watershed such as land use, hydrologic subbasins, and slope.

Hydrologic routing in the HEC-SAM model uses HEC-1 (Reference 2) and has considered the additional storage in the Twelve Towns drainage system as well as head loss in the pollution control structure at the outlet. Neither factor had been considered in previous analyses, and as a result, the 100-year floodflows have been reduced by about 20 to 25 percent. The peak flows out of the Twelve Towns drainage system have been routed downstream using the HEC-1 capabilities of the HEC-SAM model.

The revised discharges for Red Run Drain are shown in the following table.

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TABLE 4 - REVISED SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
RED RUN DRAIN					
just downstream of the confluence of Big Beaver Creek	90.6	9,210	13,320	14,260	17,650
just downstream of the confluence of Bear Creek	86.0	8,580	12,280	13,000	15,610
just upstream of the confluence of Bear Creek	63.6	6,510	8,680	8,680	8,680

The starting water-surface elevations for Red Run Drain were obtained from a DAMBRK analysis (Reference 3), which modeled the confluence of Red Run Drain and the Clinton River. The revised flood profiles were computed using the COE HEC-2 step-backwater computer model (Reference 4).

The cross-section data and Mannings "n" values remain unchanged from the original hydraulic analysis.

9.5 Floodways

Floodway computations for Red Run Drain were revised as a result of revised hydrology and hydraulics. The floodways were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was revised and are presented in Table 2, Floodway Data.

9.6 Location of Data

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 300 South Wacker Drive, Chicago, Illinois 60606.

9.7 References and Bibliography

1. U.S. Army Corps of Engineers, Detroit District, Working Paper on Clinton River Watershed Study and HEC-SAM Model, 1983.

2. ————, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package Users Manual, 1981.

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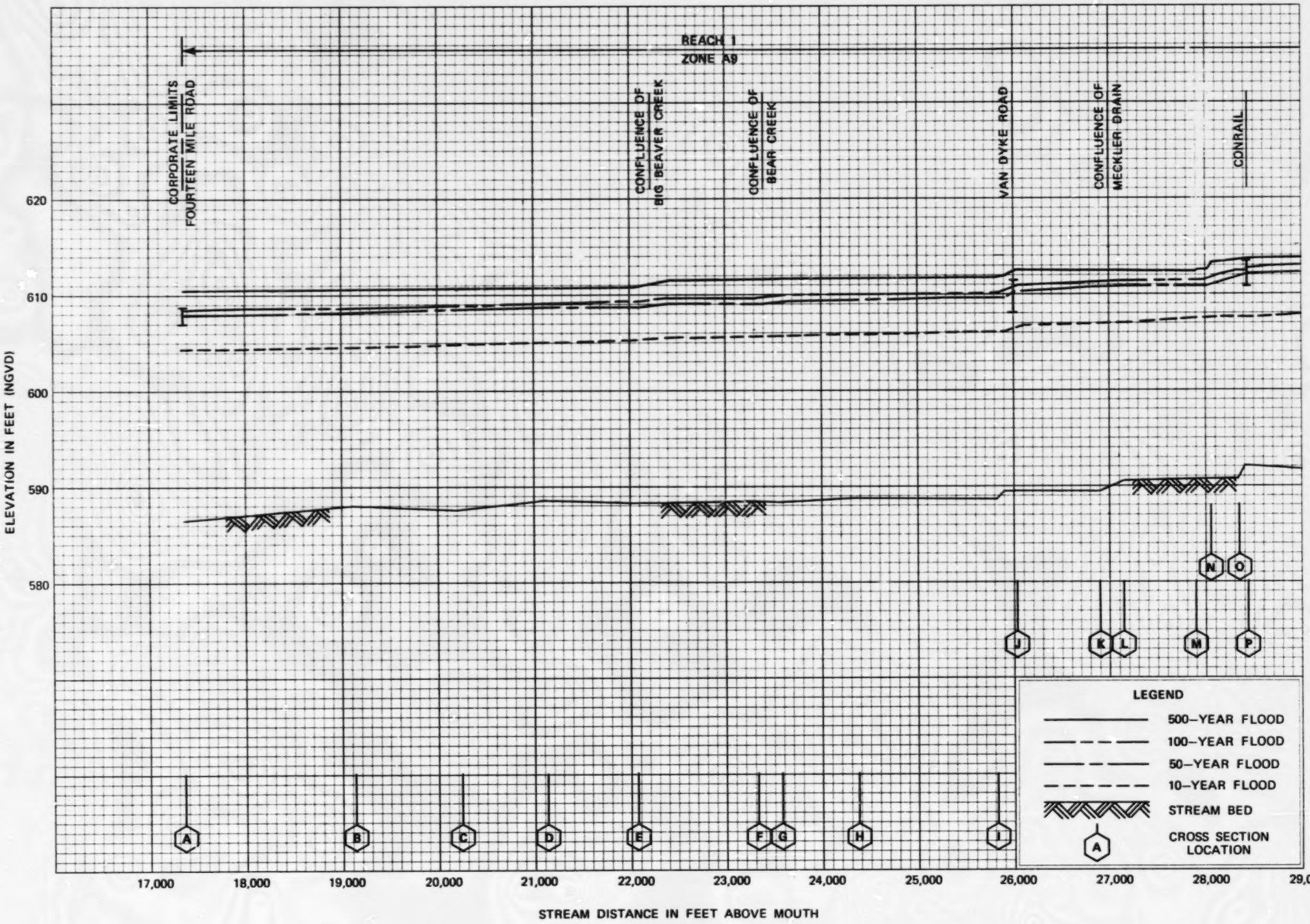

FLOOD PROFILES

RED RUN DRAIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI
(MACOMB CO.)

01P

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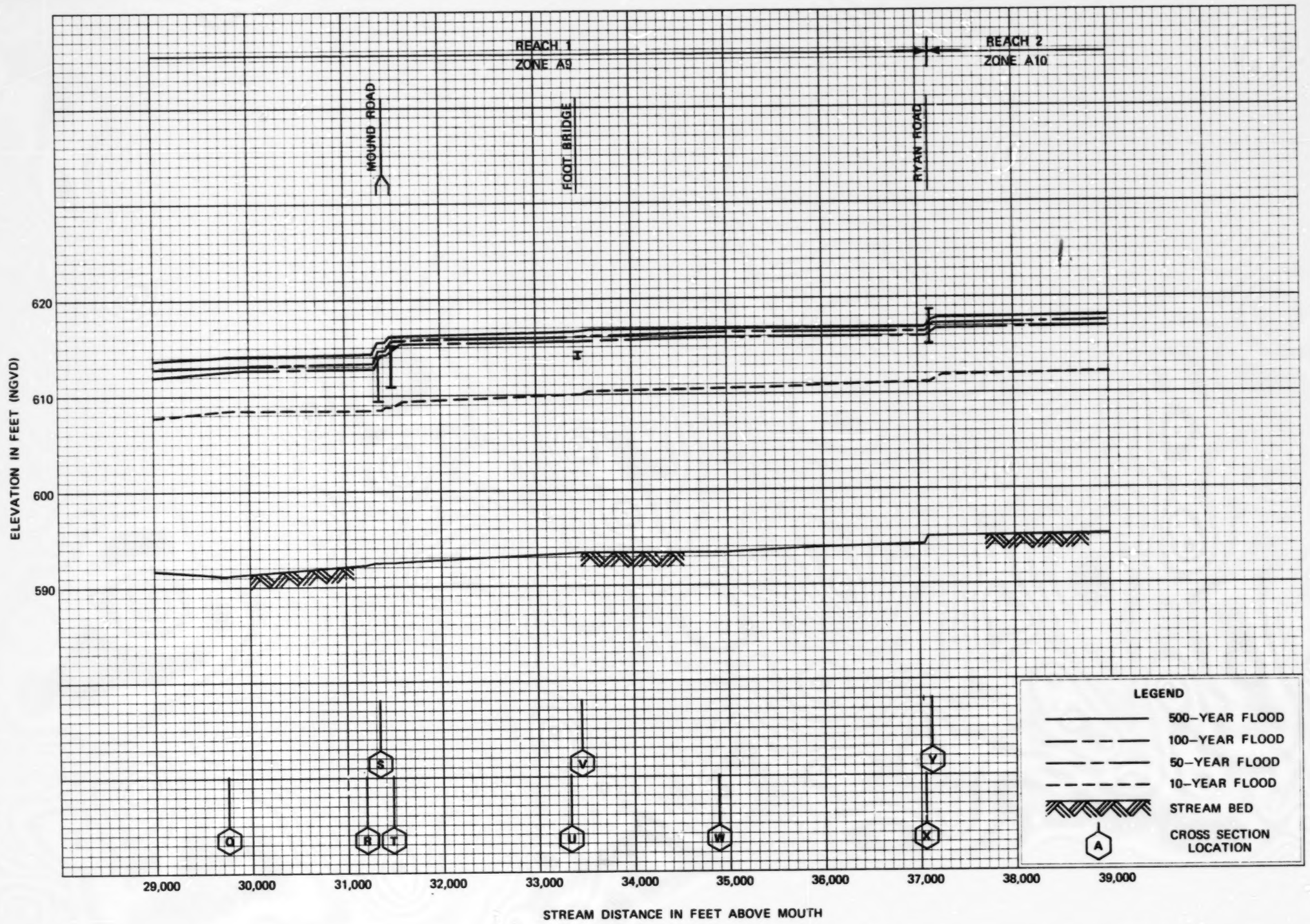

FLOOD PROFILES

RED RUN DRAIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI
(MACOMB CO.)

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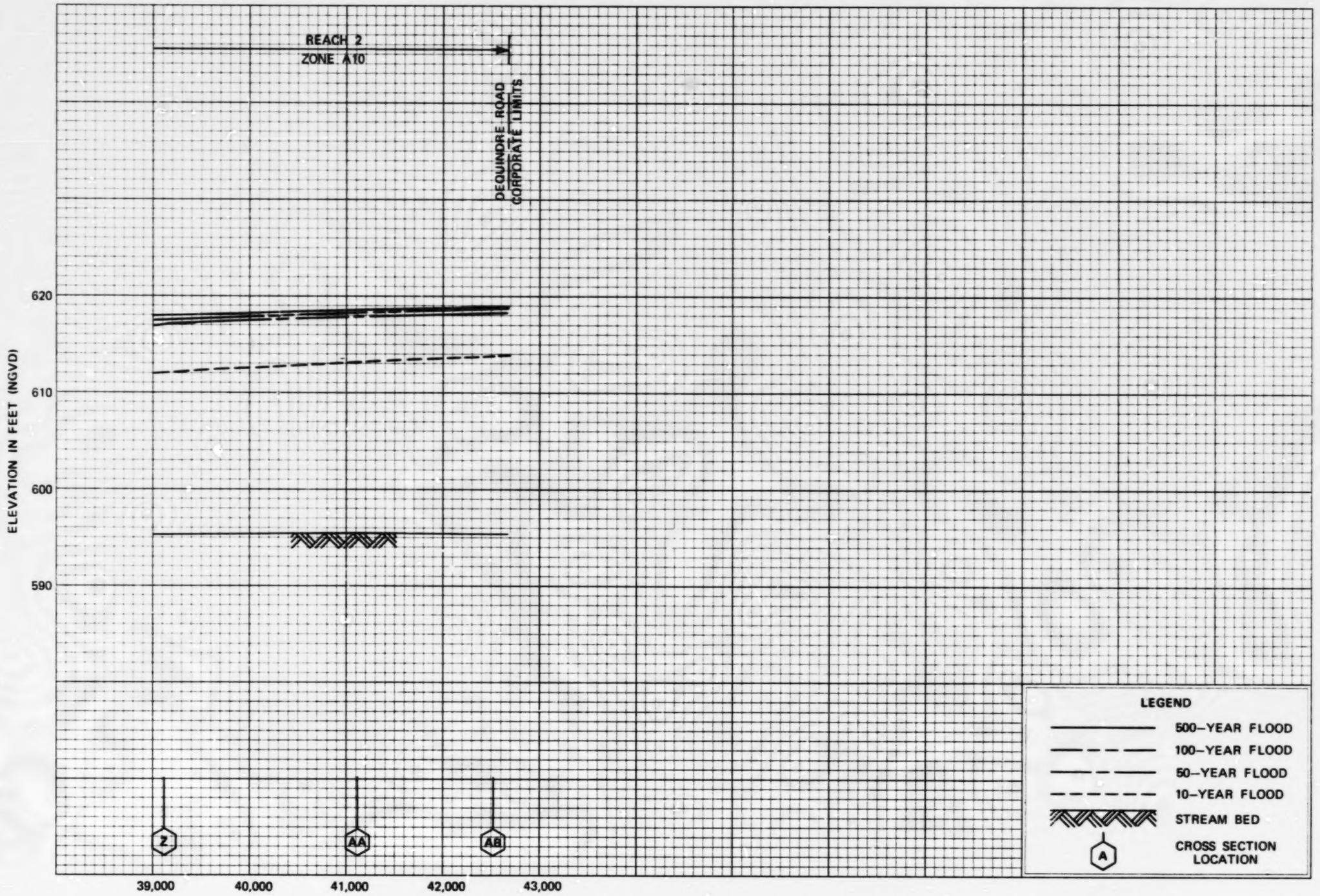

FLOOD PROFILES

RED RUN DRAIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI

(MACOMB CO.)

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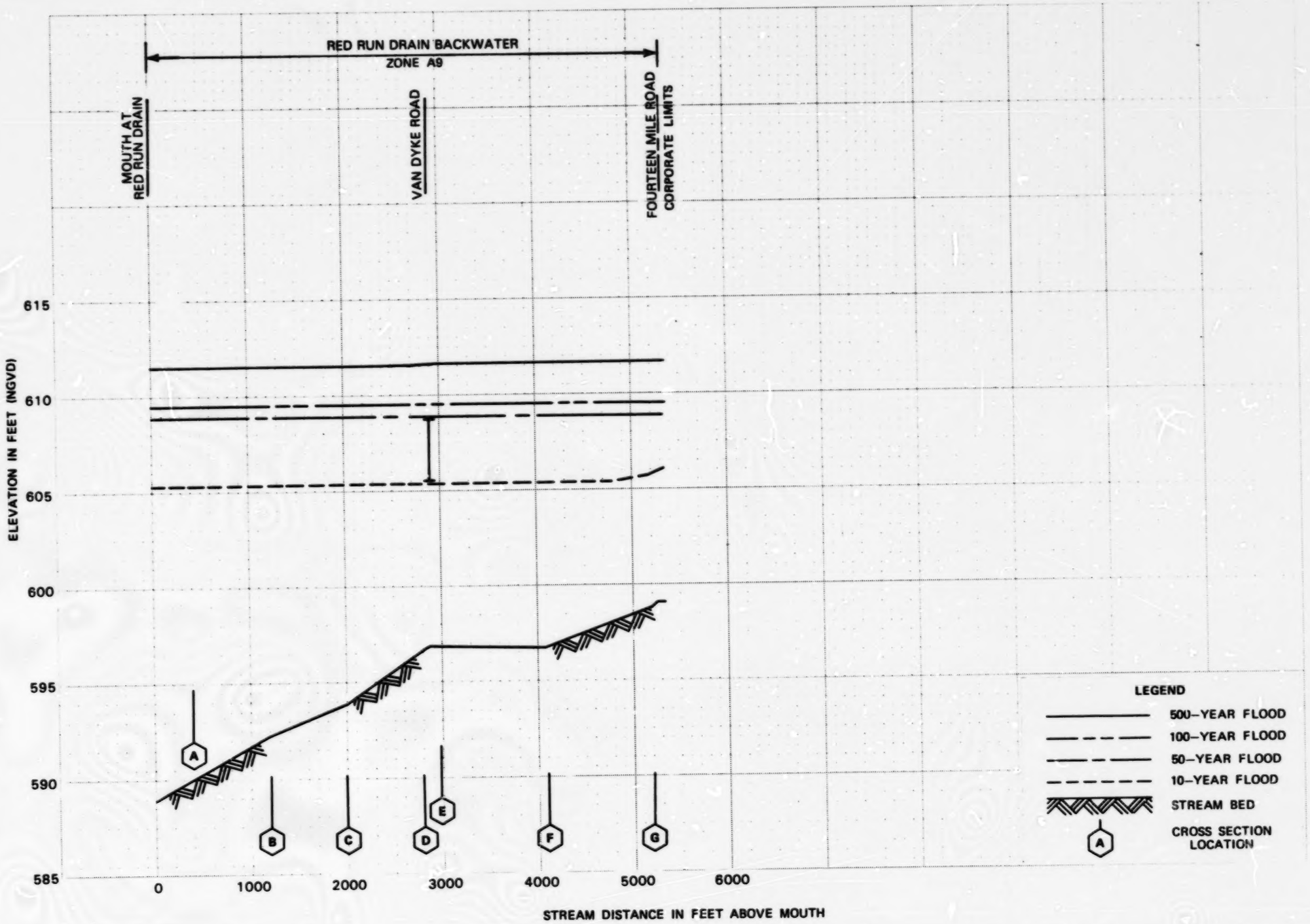

FLOOD PROFILES

BIG BEAVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI
(MACOMB CO.)

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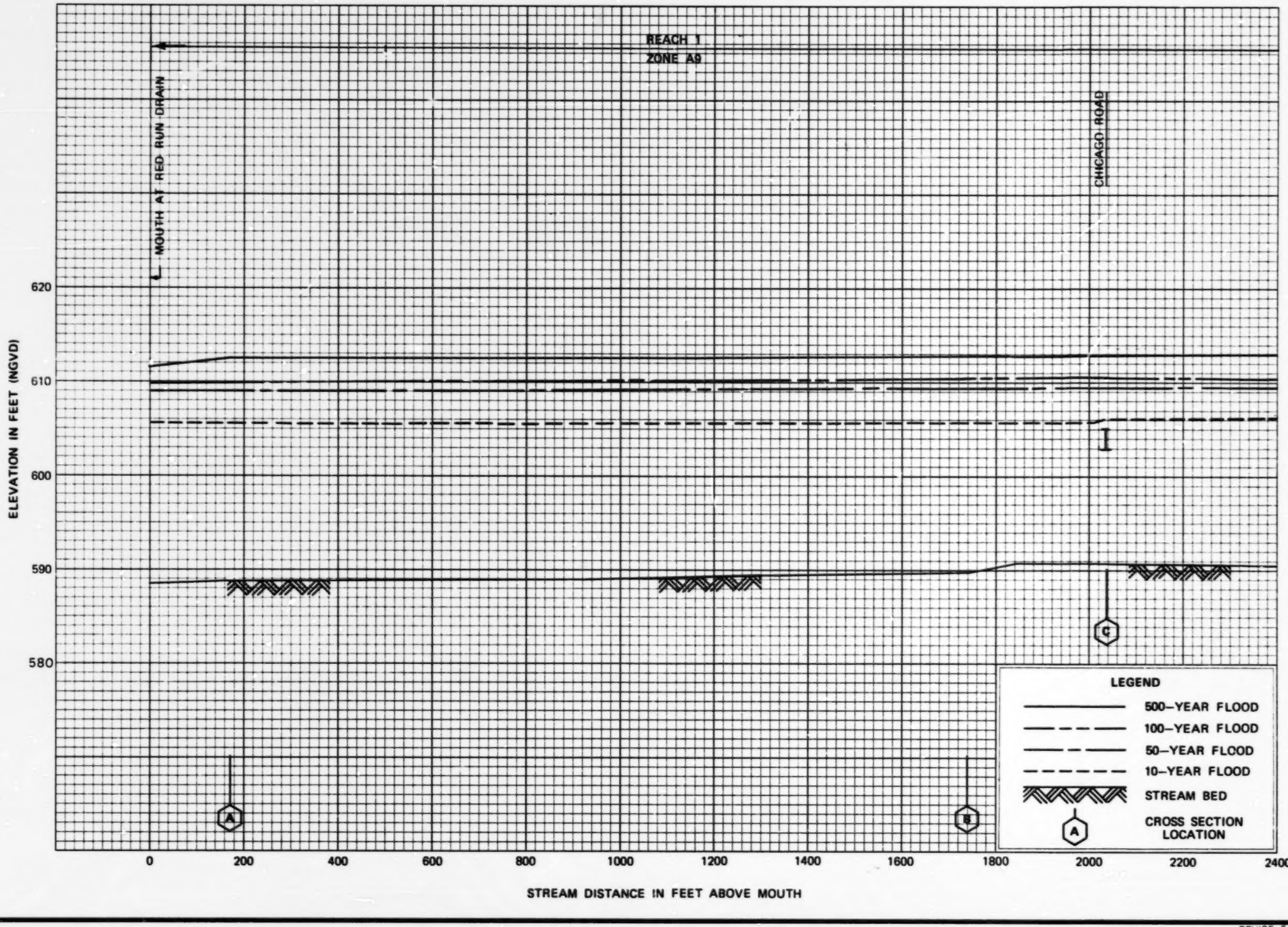

FLOOD PROFILES

BEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI
(MACOMB CO.)

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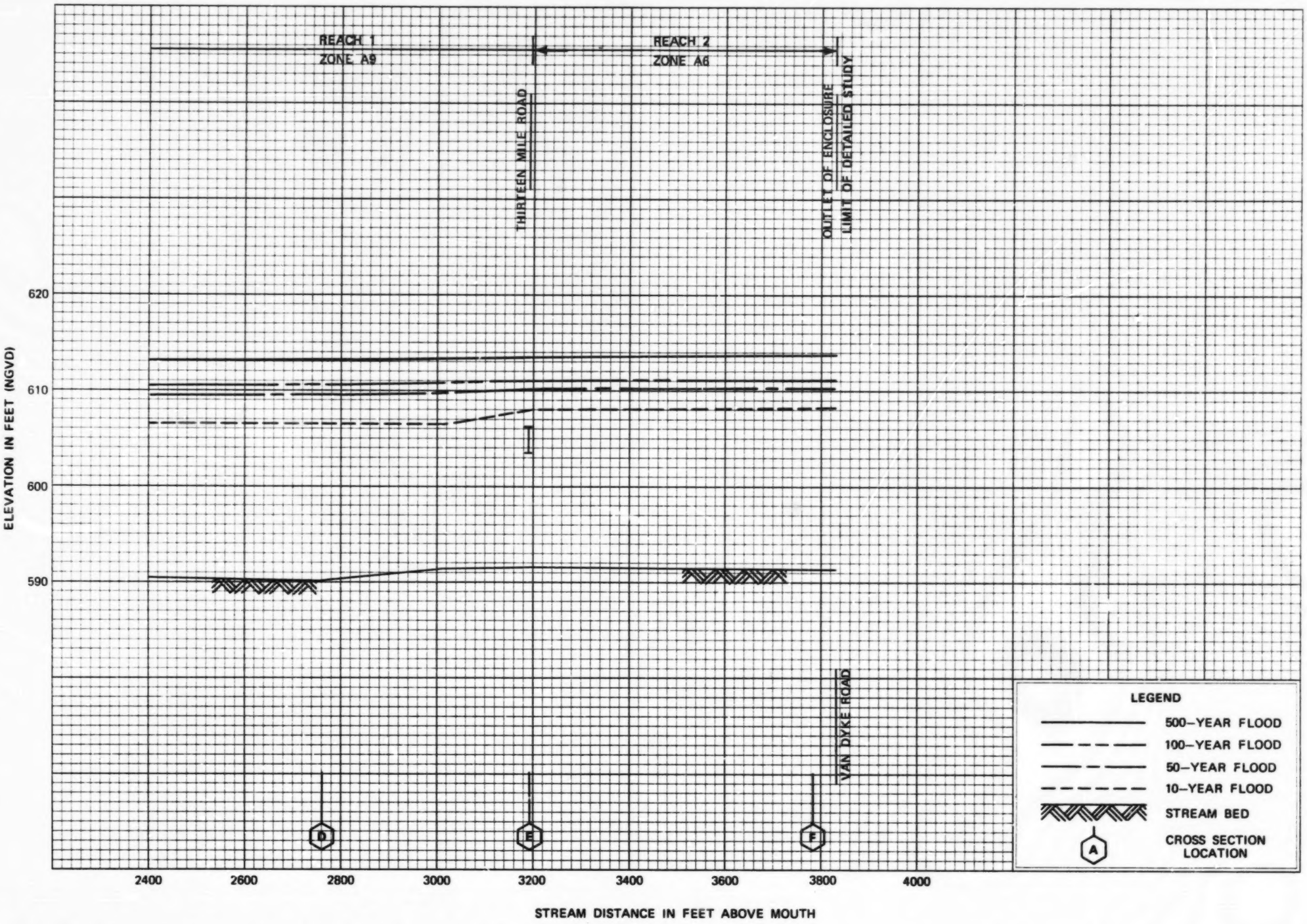

FLOOD PROFILES

BEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI
(MACOMB CO.)

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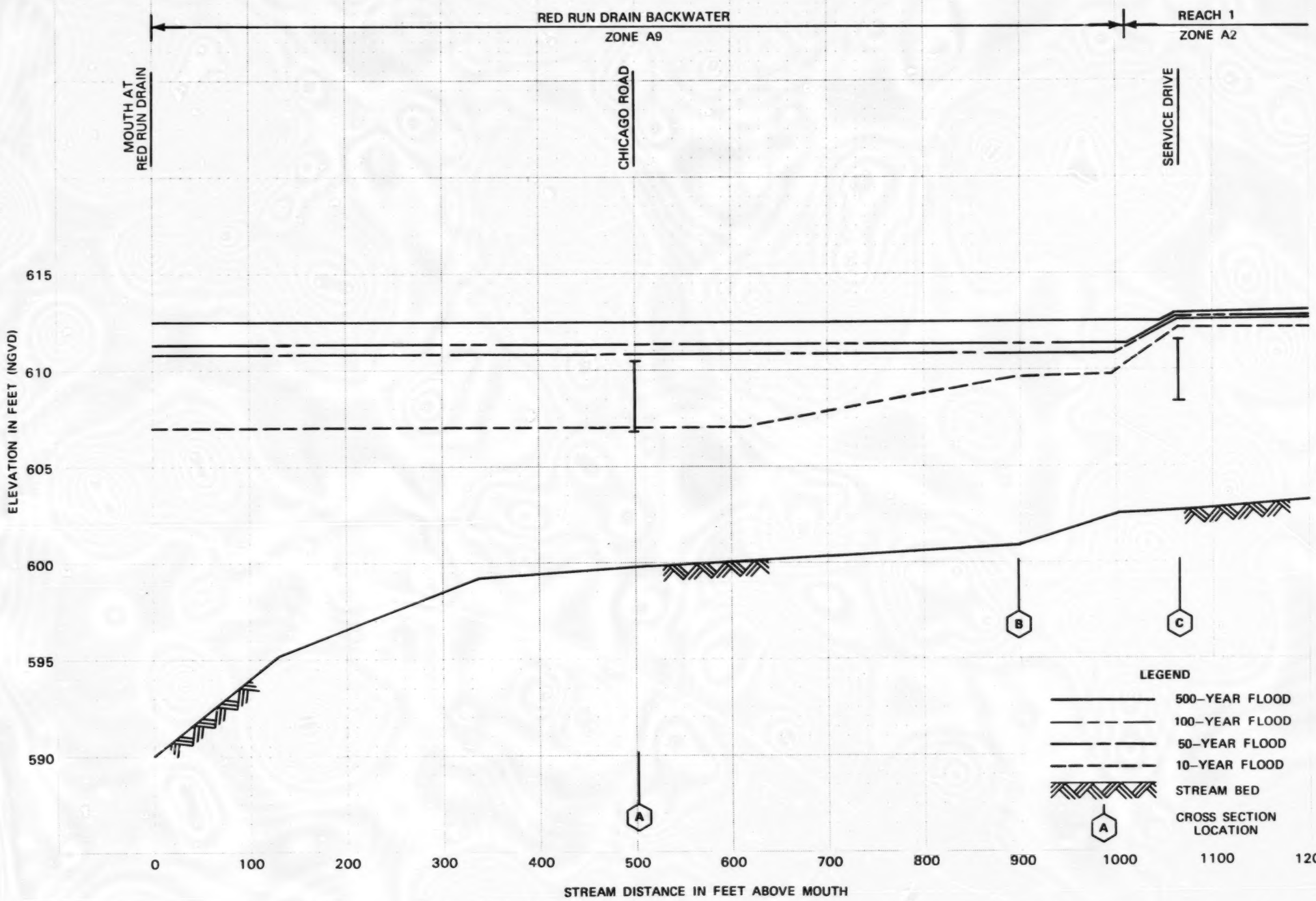

FLOOD PROFILES

MECKLER DRAIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WARREN, MI

(MACOMB CO.)

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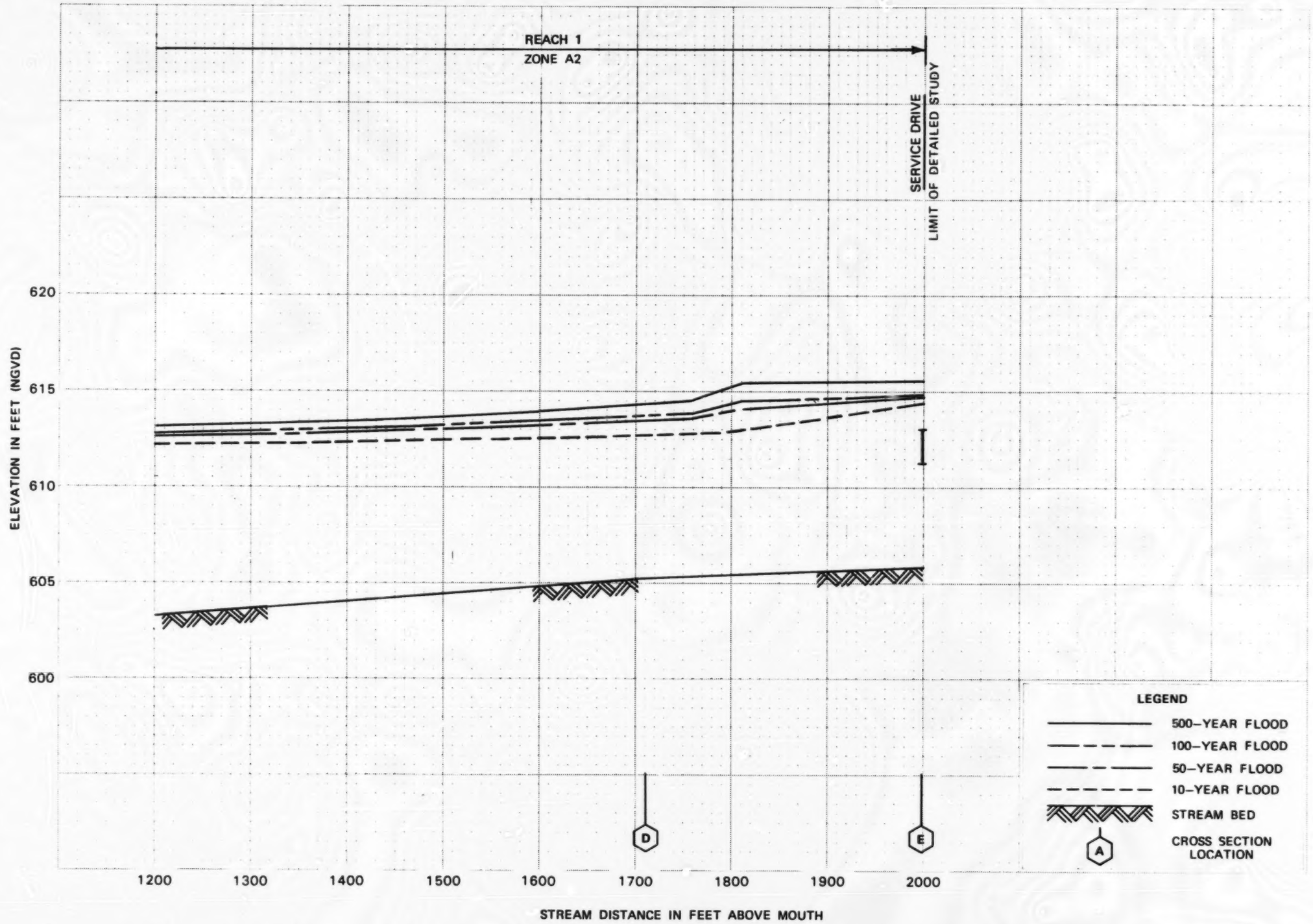

FLOOD PROFILES

MECKLER DRAIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

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